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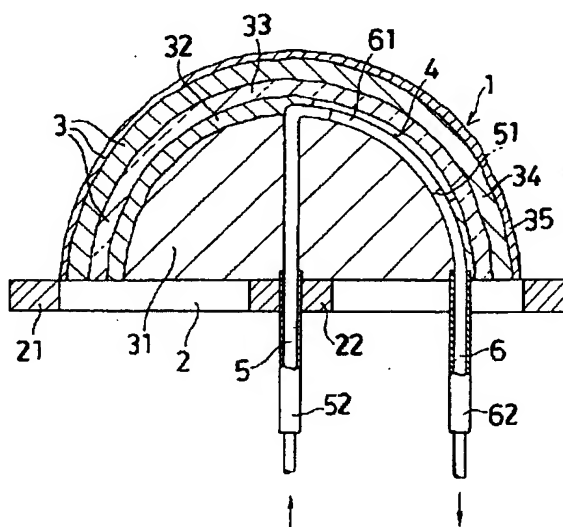
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(54) 【発明の名称】 生体の光学ファントム及びその製造方法

(57) 【要約】

【課題】 ファントムの内部において、時間によって変動する動的活動状態を模擬させて光学的に測定することができるようにした。

【解決手段】 対象とする生体の部位の形状を複数のファントム層を積層することにより構成し、前記複数のファントム層のうちの1以上のファントム層の一部に空洞部4を設け、前記空洞部4には外部に開口する入口流路5と出口流路6とを接続し、前記入口流路5から流入させる液体ファントムを空洞部4に流して出口流路6から流出させることにより、時間によって変動する動的活動状態を模擬させて光学的に測定するようにした。



【特許請求の範囲】

【請求項 1】 対象とする生体の部位の形状を複数のファントム層を積層することにより構成し、前記複数のファントム層のうちの 1 以上のファントム層の一部に空洞部を設け、前記空洞部には外部に開口する入口流路と出口流路とを接続し、前記入口流路から流入させる液体ファントムを空洞部に流して出口流路から流出させることにより、時間によって変動する動的活動状態を模擬させて光学的に測定するようにしたことを特徴とする生体の光学ファントム。

【請求項 2】 複数のファントム層は光学特性を調整したエポキシ樹脂、ポリエステル樹脂等を原料として使用し、複数の各ファントム層ごとにメス型を作製して複数のファントム層を順に積層させて構成してなる請求項 1 に記載の生体の光学ファントム。

【請求項 3】 台座に流路素材を設け、前記台座の表面に前記流路素材が埋設されるようにしてメス型により 1 若しくは複数のファントム層を形成した後、前記流路素材が接触するように空洞用素材部を設けてメス型により空洞用素材部を含むファントム層と、その外側のファントム層を形成したら、前記流路素材を除去して入口流路、出口流路を構成するとともに空洞用素材部を前記流路から排出させ、その後外面に所望のファントム層を形成するようにしたことを特徴とする生体の光学ファントムの製造方法。

【請求項 4】 流路素材は樹脂に接着しない素材で、また空洞用素材部は寒天、ゼラチン等加温により容易に液体化する原料、あるいは化学薬品により容易に液体化する原料で、空洞用素材部を含むファントム層と、その外側のファントム層を形成したら、加温、あるいは化学薬品を注入させることにより空洞用素材部を液体化させるようにしたことを特徴とする請求項 3 に記載の生体の光学ファントムの製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、医療診断や治療機器の開発において、時間によって変動する動的活動状態を測定することができる生体の光学ファントム及びその製造方法に関するものである。

【0002】

【従来の技術】光を利用した医療の診断機器や治療機器の開発において、光が生体の内部をどのように伝播し、また生体のどの部分を診断したり治療するかを明確にすることはきわめて困難である。そこで、人体、その他の生体を光学的に模擬したファントムを作製し、このファントム内に各種の病変部や組織の活動を模擬した部分を設けることができれば、診断機器や治療機器の有効性を正確に評価することができる。

【0003】

【発明が解決しようとする課題】従来では、平板状又は

円筒状のファントムが作製されているが、生体に酷似するような光学ファントムは提案されていない。また、本発明者等は、人体を模擬している光学ファントムをすでに提案しているが、例えば筋肉、脳若しくは血流のように、時間によって変動する動的活動状態を光学的に測定することができるファントムは未だ提案されていない。そこで本発明者等は、時間によって変動する動的活動状態を測定することができるファントムを今回初めて提案することを目的とする。

10 【0004】

【課題を解決するための手段】本発明の前記目的を達成するため、本発明は、対象とする生体の部位の形状を複数のファントム層を積層することにより構成し、前記複数のファントム層のうちの 1 以上のファントム層の一部に空洞部を設け、前記空洞部には外部に開口する入口流路と出口流路とを接続し、前記入口流路から流入させる液体ファントムを空洞部に流して出口流路から流出させることにより、時間によって変動する動的活動状態を模擬させて光学的に測定するようにしたことを特徴とする生体の光学ファントム、及び、台座に流路素材を設け、前記台座の表面に前記流路素材が埋設されるようにしてメス型により 1 若しくは複数のファントム層を形成させた後、前記流路素材が接触するように空洞用素材部を設けてメス型により空洞用素材部を含むファントム層とその外側のファントム層を順に形成したら、前記流路素材を除去して入口流路、出口流路を構成するとともに空洞用素材部を前記流路から排出させ、その後外面に所望のファントム層を形成するようにしたことを特徴とする生体の光学ファントムの製造方法を提供する。

30 【0005】

【発明の実施の形態】以下に本発明を図面に示す実施の形態に基づいて説明する。本発明の光学ファントム 1 は、図 1 に示すように、概略すると台座 2 の表面に複数のファントム層 3 を積層させ、1 以上のファントム層 3 の一部に空洞部 4 を設け、前記空洞部 4 を入口流路 5 と出口流路 6 に連通させ、各流路 5、6 を外部に開口させた構成である。

【0006】前記台座 2 は、図面に示す実施の形態では合成樹脂製で、円環材 2 1 の内部に補強材 2 2 を十字状に設けた構成であるが、本発明ではそれ以外のどのような材質で成形して、しかもどのような構成であってもよい。

【0007】前記光学ファントム 1 としては人体の頭部を模擬しており、またファントム層 3 は、図面の実施の形態では内部から外部に向かって 5 つのファントム層を積層してあり、最も内側の第 1 ファントム層 3 1 が白質を、その外側の第 2 ファントム層 3 2 が灰白質を、その外側の第 3 ファントム層 3 3 が脳脊髄液の層を、その外側の第 4 ファントム層 3 4 が頭蓋骨層を、その外側であって最外側の第 5 ファントム層 3 5 が頭部の皮膚層を、

それぞれ想定している。

【0008】前記第1ファントム層31から第5ファントム層35までの各層は、エポキシ樹脂あるいはポリエステル樹脂等に酸化チタン粒子、インク、染料等を調整して混合することにより、それぞれの頭部の部位に対応する光学特性を持った構成とする。

【0009】そして、前記第1ファントム層31から第5ファントム層35のうちの1以上のファントム層の一部に、生体の細胞や組織等の活動部位あるいは病変部を模擬する位置に前記空洞部4を設けるとともに、血管を模擬する前記入口流路5と出口流路6を前記空洞部4に接続して外部に連通させ、病変部や組織活動を模擬するファントム液体を、外部にの設けた液体循環機構を使用して入口流路5から空洞部4に流し込み、出口流路6から流出させることにより、筋肉や脳の活動により変化する血流、その他の液体を模擬させることができ、ファントムの内部において、時間によって変動する動的活動状態を模擬させて光学的に測定することができる。したがって、本発明の光学ファントム1は、人体、動物等の生体の一部の部位に活動部位や病変部を模擬させるとともに、その部位に血流、組織中の酸素の流れ、細胞内の糖分の変化等を疑似させることにより、時間によって変動する動的活動状態を模擬させて光学的に測定することができるものである。

【0010】以下に本発明の光学ファントム1の製造方法を、図2以下に示す実施の形態に基づいて説明する。

【0011】前記光学ファントム1の説明では、人体の頭部を模擬しているため、製造方法においてもそのファントムを作製する方法を以下に説明する。予め、MRIやX線CT等の三次元形状データ収集装置を使用して解剖学的分類から頭部の複数の断層像データを得て、光学ファントムのモデルデータを作製する。次に、上記複数のモデルデータを光造形機に供給して各断層毎に光硬化性樹脂等を使用して原型を作製し、各原型からシリコンゴムを原材料としてメス型を作製する。したがって、図1の実施の態様に示す光学ファントムでは、第1ファントム層31から第5ファントム層35までを成形するための5個のシリコンゴム製の第1メス型311から第5メス型351までを予め作製して準備する。

【0012】前記台座2の中心位置に、入口流路5を形成するための第1流路素材51を挿通させるとともに、前記第1流路素材51にチューブ状の液体ファントム流入路52を装着して、第1ファントム層31の外面形状を成形する第1メス型311の開口部に載置し、台座2の開口部から第1メス型311の開口部に、エポキシ樹脂あるいはポリエステル樹脂等に酸化チタン粒子、インク、染料等を混合することにより光学特性が所望に調整された原料を供給する(図2)。そして、前記第1メス型311の内部に供給した原料が硬化した時に脱型することにより、第1メス型311の内面形状に一致する第

1ファントム層31が台座2に成形される。なお、前記第1流路素材51は、エポキシ樹脂あるいはポリエステル樹脂に接着しないで屈曲できる、例えばテフロン樹脂で棒状に若しくはチューブ状に成形したものを、また前記流入路52は前記エポキシ樹脂あるいはポリエステル樹脂に接着する樹脂でチューブ状に成形したものを使用する。

【0013】前記第1メス型311を外して台座2に第1ファントム層31を形成すると、接着しない樹脂で成形した第1流路素材51を押し出して第1ファントム層31の外面に第1流路素材51の先端部を突出させる(図3)。

【0014】前記第1ファントム層31の外面から突出する第1流路素材51の先端部を、第1ファントム層31の外面に接触するように屈曲させるとともに出口流路6を形成するための第2流路素材61を第1ファントム層31の外面に沿わせるようにして設け、前記第1流路素材51の先端部と第2流路素材61の先端部とを第1ファントム層31の外面において積層させる(図4)。そして、前記第2流路素材61にチューブ状の液体ファントム流出路62を装着するが、前記第2流路素材61は第1流路素材51と同様に第1ファントム層31に接着しない樹脂の成形品を、また流出路62は接着する樹脂の成形品を使用する。

【0015】前記のように、第1ファントム層31の外面に第1流路素材51の先端部と第2流路素材61の先端部とを沿わせて一部重ね合わせたら、前記第2ファントム層32の外面形状を成形する第2メス型321の開口部にあてがって、第1ファントム層31を第2メス型321の内部に埋没させる。そして、第1ファントム層31の外面と第2メス型321の内面とで構成する空隙部に空洞用素材41を注入して硬化したら、脱型するとともに空洞部4を構成する部分だけの空洞用素材41を残してその他の空洞用素材41を切削除去し、残存する空洞用素材41の部分を空洞用素材部42とする(図5)。この場合、空洞用素材部42の内部には、前記第1流路素材51と第2流路素材61の先端部が埋め込まれた状態で存在する。前記空洞用素材41としては、常温ではある程度形状を維持しているが、加温すると容易に液状化する寒天、ゼラチン等の原料、あるいは化学薬品により容易に液状化する原料を使用することができる。

【0016】したがって、図5の(d)で示すように第1ファントム層31の外面の一部には、第1流路素材51と第2流路素材61の先端部が連結されている空洞用素材部42が設けられている。

【0017】前記した空洞用素材部42を有する第1ファントム層31を、再び第2メス型321の開口部にあてがって内部に没入させ、第1ファントム層31の外面と第2メス型321の内面との空隙部に、第2ファント

ム層 32 を成形するために、エポキシ樹脂あるいはポリエステル樹脂等に酸化チタン粒子、インク、染料等を混合することにより光学特性が所望に調整された原料を供給して硬化させ、脱型する（図 6）。したがって、前記した第 1 ファントム層 31 の外面には、一部に空洞用素材部 42 を設けてあるが、その他の部分に第 2 ファントム層 32 が被覆して成形されることになる（図 6（c））。

【0018】次に、前記台座 2 に第 1 ファントム層 31 と第 2 ファントム層 32 との 2 層を有するファントム 10 を、第 3 ファントム層 33 を成形する第 3 メス型 331 の開口部にあてがって内部に埋没させ、前記第 3 メス型 331 の内面と第 2 ファントム層 32 の外面とにより形成される空隙部内に、第 3 ファントム層 33 を成形するために、エポキシ樹脂あるいはポリエステル樹脂等に酸化チタン粒子、インク、染料等を混合することにより光学特性が所望に調整された原料を供給して硬化させ、脱型する（図 7）。したがって、一部に空洞用素材部 42 を有する第 2 ファントム層 32 の外面に第 3 ファントム層 33 が被覆して成形され、台座 2 に 3 層が積層するファントムとなる（図 7（c））。

【0019】前記した 3 層のファントムを成形したら、屈曲できる第 1 流路素材 51 と第 2 流路素材 61 とを引き抜くことにより第 1 ファントム層 31 と第 2 ファントム層 32 とに入口流路 5 と出口流路 6 とを形成するとともに、入口流路 5 と出口流路 6 との先端開口部に流入路 52、流出路 62 を存在させる（図 8（b））。この状態において、加温・加熱機構 101 を使用して第 1 ファントム層 31、第 2 ファントム層 32 及び第 3 ファントム層 33 の各原料に変性を与えない程度の温度で加温して前記空洞用素材部 42 を液状化させる（図 8（c））。

また、空洞用素材が化学薬品により容易に溶解して液状化する材料であれば、流入路 52 から化学薬品を注入して空洞用素材を溶解させる。この場合、化学薬品としては、第 1 ファントム層 31、第 2 ファントム層 32 及び第 3 ファントム層 33 の各層を構成するエポキシ樹脂やポリエステル樹脂と反応しないものでなければならない。

【0020】前記空洞用素材部 42 が軟化して十分に液状化したら、流入路 52 に圧力供給機構 102 を接続して液状化している空洞用素材部 42 に空気若しくは温水の圧力を作用させ、空洞用素材部 42 を流出路 62 から外部に排出する。この場合、第 3 ファントム層 33 を透明な層として、空洞用素材部 42 を着色して第 2 ファントム層 32 に対し色彩を相違させると、空洞用素材部 42 が排出されるのを第 3 ファントム層 33 を通して簡単に確認することができ、空洞用素材部 42 が排出されることにより第 2 ファントム層 32 に空洞部 4 が構成されて、前記空洞部 4 が第 1 ファントム層 31 の外面と第 3 ファントム層 33 の内面とで挟まれている。したがっ

て、台座 2 には第 1 ファントム層 31 と、空洞部 4 を有する第 2 ファントム層 32 及び第 3 ファントム層 33 の 3 層が積層するファントムが成形される（図 9（b））。

【0021】前記 3 層のファントムを、第 4 ファントム層 34 を成形するための第 4 メス型 341 の開口部にあてがって内部に埋没させ、第 4 メス型 341 の内面と第 3 ファントム層 33 の外面とにより形成される空隙部内に、第 4 ファントム層 34 を成形するために、エポキシ樹脂あるいはポリエステル樹脂等に酸化チタン粒子、インク、染料等を混合することにより光学特性が調整された原料を供給して硬化させ、脱型して第 1 ファントム層 31 から第 4 ファントム層 34 の 4 層を積層したファントムを成形する（図 10）。

【0022】次いで前記 4 層のファントムを、第 5 ファントム層 35 を成形するための第 5 メス型 351 の開口部にあてがって内部に埋没させ、第 5 メス型 351 の内面と第 4 ファントム層 34 の外面とにより形成される空隙部内に、第 5 ファントム層 35 を成形するために、エポキシ樹脂あるいはポリエステル樹脂等に酸化チタン粒子、インク、染料等を混合することにより光学特性が調整された原料を供給して硬化させ、脱型して第 1 ファントム層 31 から第 5 ファントム層 35 の 5 層を積層したファントムを成形する（図 11）。

【0023】前記した方法により、各ファントム層において光学特性が調整され、しかも一部に空洞部 4 を設けてファントム液を供給できる入口流路 5 及び排出できる出口流路 6 を形成した本発明の光学ファントム 1 を製造できるのである。

【0024】以上本発明を図面に示す実施の形態に基づいて説明したが、本発明は前記実施の形態に限定されるものではなく、特許請求の範囲に記載の構成を変更しない限りどのようにでも実施できる。例えば、人体ばかりではなく、動物のあらゆる部位に相当するファントムが作成可能であるし、空洞部に流すファントム液体としては、血流、組織内の酸素の変動状態、細胞内の糖分変化等あらゆる状態を想定することができる。また、ファントム層は前記実施の形態に示すように 5 層以外の複数層設けることができるし、空洞部もどの層にでも、どのような位置にでも設けることができる。更に、本発明での上記説明において、流入路 52 及び流出路 62 を一体成形することは必須要件ではなく、ファントムの成形後に入口流路 5 と出口流路 6 の開口端部に、接着剤、ネジ機構等によりパイプ状の流入路 52 及び流出路 62 をそれぞれ離脱不能に取り付けてもよい。

【0025】

【発明の効果】以上要するに、本発明によれば対象とする生体の部位の形状を複数のファントム層を積層することにより構成し、前記複数のファントム層のうちの 1 以上のファントム層の一部に空洞部を設け、前記空洞部に

は外部に開口する入口流路と出口流路とを接続し、前記入口流路から流入させる液体ファントムを空洞部に流して出口流路から流出させることにより、時間によって変動する動的活動状態を模擬させて光学的に測定するようにしたことを特徴とする。したがって、人体、動物等の生体の一部の部位に活動部位や病変部を空洞部によって模擬させるとともに、その部位に血流、組織中の酸素の流れ、細胞内の糖分の変化等を疑似させることにより、時間によって変動する動的活動状態を模擬させて光学的に測定することができるので、光を利用した医療の診断機器や治療機器の開発において、光が生体の内部をどのように伝播し、また生体のどの部分を診断したり治療するかを明確にすることができ、特に診断機器や治療機器の有効性を正確にしかも高い精度で評価することができるばかりでなく、生体の診断や治療の分野において著しく貢献することができる。

【0026】しかも、台座の表面にメス型により1若しくは複数のファントム層を形成するとともに空洞用素材部を設け、その空洞用素材部を排出させることにより空洞部を設けて光学ファントムを製造するようにしたので、著しく簡単に、どのような形態のファントムでも作製することができ、特に医学業界における診断や治療において著しく実用的価値の高いものとなる。

【図面の簡単な説明】

【図1】本発明の実施の形態を示す生体の光学ファントムの縦断面図である。

【図2】第1ファントム層を作製する状態の概略図で、(a)は斜視図、(b)は縦断面図である。

【図3】台座に第1ファントム層を成形した状態の概略斜視図である。

【図4】第1ファントム層の表面に第1流路素材と第2流路素材とを作製する状態の概略説明図で、(a)は第1流路素材を延長した状態の斜視図、(b)は第1流路素材を第1ファントム層の外面に沿って屈曲させた状態の斜視図、(c)は第2流路素材を第1ファントム層の外面に沿って屈曲させた状態の斜視図である。

【図5】第1ファントム層の外面に空洞用素材の層を設けて空洞用素材部を作製する状態の概略説明図で、

(a)は斜視図、(b)は縦断面図、(c)は脱型した状態の斜視図、(d)は空洞用素材の一部を削除して空洞用素材部を成形した状態の斜視図である。

*【図6】第1ファントム層の表面に第2ファントム層を作製する状態の概略説明図で、(a)は斜視図、(b)は縦断面図、(c)は第2ファントム層を成形した斜視図である。

【図7】第2ファントム層の表面に第3ファントム層を作製する状態の概略説明図で、(a)は斜視図、(b)は縦断面図、(c)は第3ファントム層を成形した斜視図である。

【図8】空洞用素材部を液状化する状態の概略斜視図

で、(a)は第3ファントム層を成形した斜視図、

(b)は第1流路素材と第2流路素材とを引き抜いた状態の斜視図、(c)は加熱状態の概略斜視図である。

【図9】空洞部を形成する状態の概略斜視図で、(a)は空洞用素材部を除去する状態の斜視図、(b)は空洞用素材部を除去して空洞部を形成した斜視図である。

【図10】第3ファントム層の表面に第4ファントム層を作製する状態の概略説明図で、(a)は斜視図、

(b)は縦断面図、(c)は第4ファントム層を成形した斜視図である。

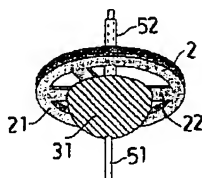
【図11】第4ファントム層の表面に第5ファントム層を作製する状態の概略説明図で、(a)は斜視図、

(b)は縦断面図、(c)は第5ファントム層を成形した斜視図である。

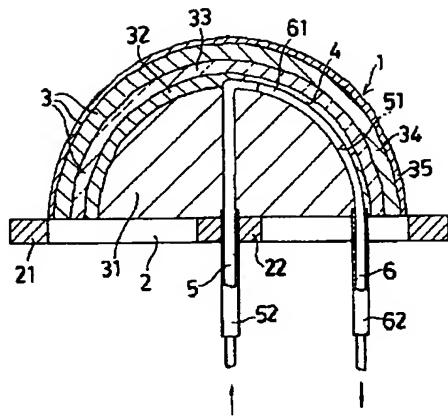
【符号の説明】

- 1 光学ファントム
- 2 台座
- 3 ファントム層
- 4 空洞部
- 5 入口流路
- 6 出口流路
- 31 第1ファントム層
- 32 第2ファントム層
- 33 第3ファントム層
- 34 第4ファントム層
- 35 第5ファントム層
- 41 空洞用素材
- 42 空洞用素材部
- 51 第1流路素材
- 52 流入路
- 61 第2流路素材
- 62 流出路

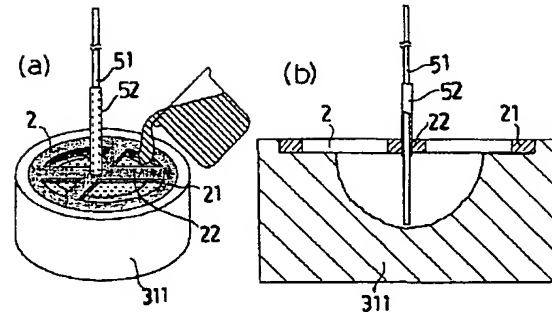
【図3】



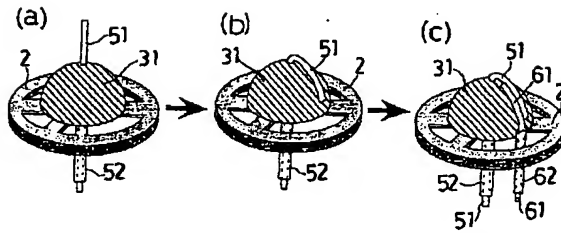
【図 1】



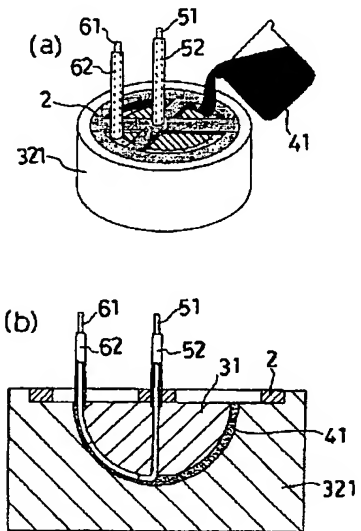
【図 2】



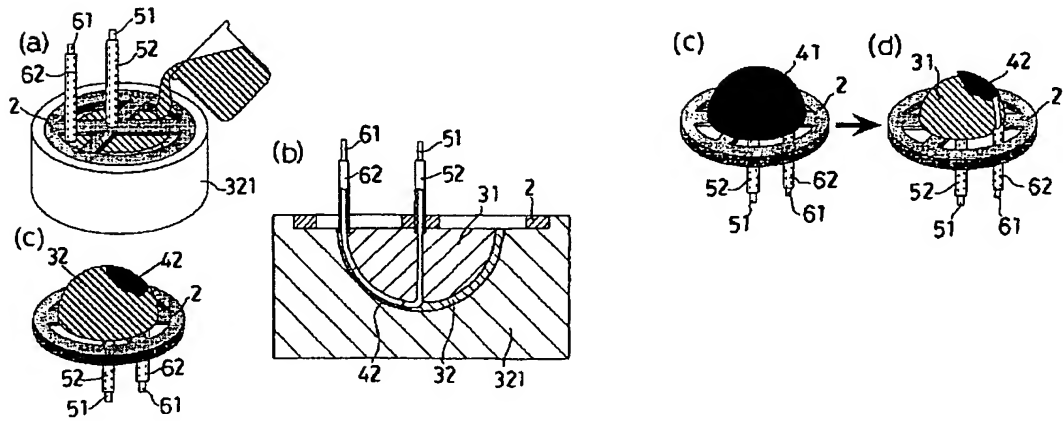
【図 4】



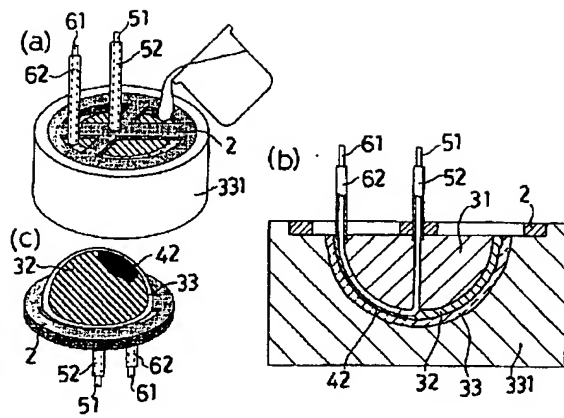
【図 5】



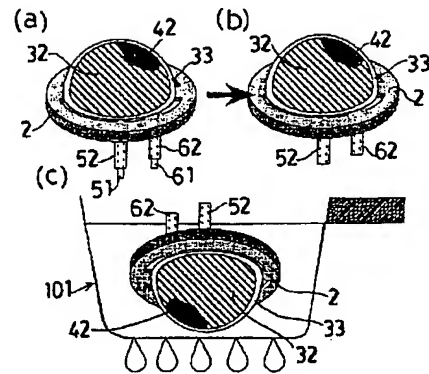
【図 6】



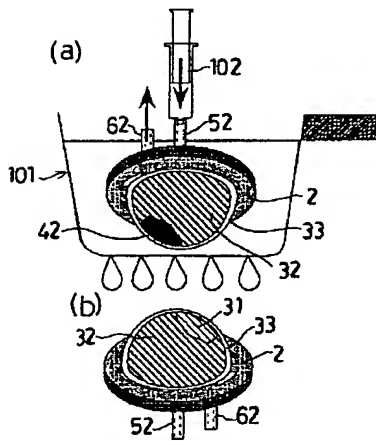
【図7】



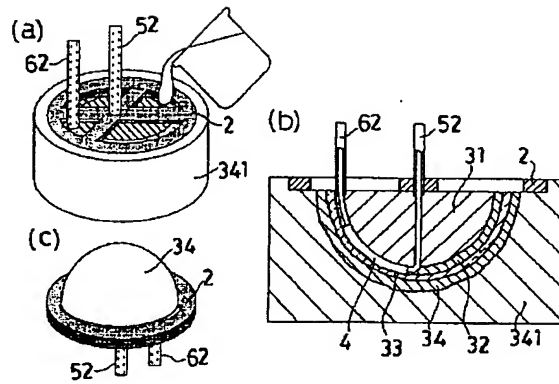
【図8】



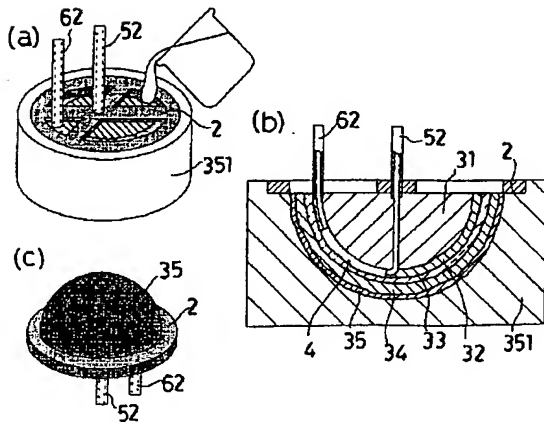
【図9】



【図10】



【図11】



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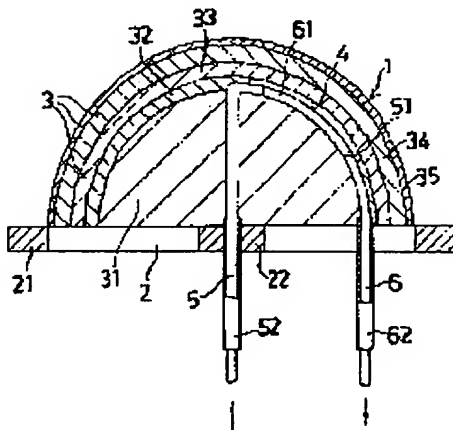
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(54) OPTICAL PHANTOM FOR ORGANISM, AND MANUFACTURE THEREOF

(57)Abstract:

PROBLEM TO BE SOLVED: To simulate the dynamic active condition to be fluctuated with the lapse of time so as to enable the optical measurement inside a phantom.

SOLUTION: Shape of an organism as an object is formed by laminating plural phantom layers, and a part of one or more phantom layers among these plural phantom layers is provided with a cavity 4, and an inlet flow passage 5 and an outlet flow passage 6 opened outside are connected to this cavity 4. The liquid phantom flowing from the inlet flow passage 5 is flowed out of the outlet flow passage 6 so as to simulate the dynamic active condition to be fluctuated with the lapse of time and optical measurement thereof is enabled.



CLAIMS

[Claim(s)]

[Claim 1] The configuration of the target living body's part is constituted by carrying out the laminating of two or more phantom layers. The cavernous section is prepared or more in a part of phantom 1 of said two or more phantom layers. By connecting the inlet-port passage and outlet passage which carry out opening outside, passing the liquid phantom made to flow from said inlet-port passage in the cavernous section, and making it flow into said cavernous section out of outlet passage The optical phantom of the living body characterized by making the dynamic active state changed by time amount simulate, and making it measure optically.

[Claim 2] Two or more phantom layers are optical phantoms of a living body according to claim 1 which use an epoxy resin, polyester resin, etc. which adjusted the optical property as a raw material, produce a female for two or more phantom layers of every, make carry out the laminating of two or more phantom layers to

order, and it comes to constitute.

[Claim 3] As a passage material is prepared in a plinth and said passage material is laid under the front face of said plinth, after forming 1 or two or more phantom layers by the female, The phantom layer which prepares the material section for cavities and contains the material section for cavities by the female so that said passage material may contact, The manufacture approach of the optical phantom of the living body characterized by making the material section for cavities discharge from said passage while removing said passage material and constituting inlet-port passage and outlet passage, if the phantom layer of the outside is formed, and forming a desired phantom layer outside after that.

[Claim 4] A passage material is a material which is not pasted up on resin, and the material section for cavities is the raw material easily liquid-ized by warming, such as an agar and gelatin, or the raw material easily liquid-ized with chemicals. The manufacture approach of the optical phantom of the living body according to claim 3 characterized by making it make the material section for cavities liquid-ize by making warming or chemicals pour in when forming the phantom layer containing the material section for cavities, and the phantom layer of the outside.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to optical phantom and its manufacture approach of the living body which can measure the dynamic active state changed by time amount in a medical diagnosis or development of a therapy device.

[0002]

[Description of the Prior Art] In development of a medical diagnostic device and a therapy device using light, it is very difficult to clarify how light spreads the interior of a living body, and which part of a living body is diagnosed or it treats. Then, the phantom which simulated the body and other living bodies optically is produced, and if the part which simulated the activity of various kinds of lesion sections or an organization can be prepared in this phantom, the effectiveness of a diagnostic device or a therapy device can be evaluated correctly.

[0003]

[Problem(s) to be Solved by the Invention] In the former, although the phantom of the shape of plate-like or a cylinder is produced, an optical phantom which bears a close resemblance [living body] is not proposed. Moreover, although this invention person etc. has already proposed the optical phantom which is simulating the body, the phantom which can measure optically the dynamic active state changed by time amount is not yet proposed, for example like muscles, a brain, or a blood flow. Then, this invention person etc. aims at proposing the phantom which can measure the dynamic active state changed by time amount for the first time this time.

[0004]

[Means for Solving the Problem] In order to attain said purpose of this invention, this invention The configuration of the target living body's part is constituted by carrying out the laminating of two or more phantom layers. The cavernous section is prepared or more in a part of phantom 1 of said two or more phantom layers. By connecting the inlet-port passage and outlet passage which carry out opening outside, passing the liquid phantom made to flow from said inlet-port passage in the cavernous section, and making it flow into said cavernous section out of outlet passage The optical phantom of the living body characterized by making the dynamic active state changed by time amount simulate, and making it measure optically,

And as the passage material was prepared in the plinth and said passage material was laid under the front face of said plinth, after making 1 or two or more phantom layers form by the female, When forming in order the phantom layer which prepares the material section for cavities and contains the material section for cavities by the female, and the phantom layer of the outside so that said passage material may contact While removing said passage material and constituting inlet-port passage and outlet passage, the material section for cavities is made to discharge from said passage, and the manufacture approach of the optical phantom of the living body characterized by forming a desired phantom layer outside after that is offered.

[0005]

[Embodiment of the Invention] This invention is explained based on the gestalt of operation shown in a drawing below. The optical phantom 1 of this invention is the configuration to which the front face of a plinth 2 is made to carry out the laminating of two or more phantom layers 3 when an outline is carried out, as shown in drawing 1, and formed the cavernous section 4 in a part of one or more phantom layers 3, made the inlet-port passage 5 and the outlet passage 6 open said cavernous section 4 for free passage, and opening of each passage 5 and 6 was made to carry out outside.

[0006] Although said plinth 2 is the configuration of being a product made of synthetic resin and having formed reinforcing materials 22 in the interior of the circular ring material 21 in the shape of a cross joint with the gestalt of operation shown in a drawing, it may be fabricated by this invention with the quality of the material like a throat other than this, and, moreover, may be what kind of configuration.

[0007] The head of the body is simulated as said optical phantom 1. Moreover, the phantom layer 3 With the gestalt of operation of a drawing, the laminating of the five phantom layers has been carried out toward the exterior from the interior. The 2nd phantom layer 32 of the outside white matter gray matter [the innermost 1st phantom layer 31] In the layer of cerebrospinal fluid, the 3rd phantom layer 33 of the outside is [the 4th phantom layer 34 of the outside] the outside about a skull layer, and the outermost 5th phantom layer 35 assumes the stratum cutaneum membranae tympani of a head, respectively.

[0008] Each class from said 1st phantom layer 31 to the 5th phantom layer 35 is taken as a configuration with the optical property corresponding to the part of each head by adjusting a titanium oxide particle, ink, a color, etc. to an epoxy resin or polyester resin, and mixing.

[0009] And while forming said cavernous section 4 in the location which simulates an activity part or the lesion sections, such as a living body's cell and an organization, or more to a part of phantom 1 of said 1st phantom layer 31 to the 5th phantom layers 35 Connect to said cavernous section 4 said inlet-port passage 5 and outlet passage 6 which simulate a blood vessel, and it is made outside open for free passage. By slushing into the cavernous section 4 the phantom liquid which simulates the lesion section and organization activities from the inlet-port passage 5 using the liquid circulator style which ***** prepared, and making it flow out of the outlet passage 6 The liquid of a blood flow and others which changes with the activities of muscles or a brain can be made to be able to simulate, the dynamic active state changed by time amount can be made to be able to simulate in the interior of a phantom, and it can measure optically. Therefore, by making the part carry out false [of the change of a blood flow, the flow of the oxygen under organization, and intracellular sugar etc.], the optical phantom 1 of this invention can make the dynamic active state changed by time amount able to simulate, and can be optically measured while making some parts of living bodies, such as the body and an animal, simulate an activity part and the lesion section.

[0010] The manufacture approach of the optical phantom 1 of this invention is explained based on the gestalt of operation shown below in drawing 2 below.

[0011] By explanation of said optical phantom 1, since the head of the body is simulated, how to produce the phantom also in the manufacture approach is explained below. Beforehand, two or more tomogram data of a head are obtained from an anatomical classification using three-dimensions configuration data collectors, such as MRI and X-ray CT, and the model data of an optical phantom are produced. Next, two or more above-mentioned model data are supplied to the Mitsuzo form machine, a pattern is produced for every fault using a photo-setting resin etc., and a female is produced by making silicone rubber into a raw material from

each pattern. therefore, the voice of operation of drawing 1 -- in the optical phantom shown like, from the 1st five female 311 made of silicone rubber for fabricating from the 1st phantom layer 31 to the 5th phantom layer 35 to the 5th female 351 is produced beforehand, and is prepared.

[0012] While making the 1st passage material 51 for forming the inlet-port passage 5 in the center position of said plinth 2 insert in Said 1st passage material 51 is equipped with the tube-like liquid phantom inflow way 52. It lays in opening of the 1st female 311 which fabricates the outside configuration of the 1st phantom layer 31. An optical property supplies the raw material adjusted to the request by mixing a titanium oxide particle, ink, a color, etc. from opening of a plinth 2 to an epoxy resin or polyester resin at opening of the 1st female 311 (drawing 2). And the 1st phantom layer 31 which is in agreement with the inside configuration of the 1st female 311 is fabricated by the plinth 2 by unmolding, when the raw material supplied to the interior of said 1st female 311 hardens. in addition, the Teflon resin which can be crooked without pasting up said 1st passage material 51 on an epoxy resin or polyester resin -- the shape of a rod -- or the thing fabricated in the shape of a tube -- moreover, said inflow way 52 uses what was fabricated in the shape of a tube by the resin adhered to said epoxy resin or polyester resin.

[0013] When said 1st female 311 is removed and the 1st phantom layer 31 is formed in a plinth 2, the 1st passage material 51 fabricated by the resin which is not pasted up is extruded, and the point of the 1st passage material 51 is made to project on the external surface of the 1st phantom layer 31 (drawing 3).

[0014] The point of the 1st passage material 51 which projects from the external surface of said 1st phantom layer 31 Make the 2nd passage material 61 for forming the outlet passage 6, while making it crooked so that the external surface of the 1st phantom layer 31 may be contacted there be along the external surface of the 1st phantom layer 31, and it is made and prepared in it. In the external surface of the 1st phantom layer 31, the laminating of the point of said 1st passage material 51 and the point of the 2nd passage material 61 is carried out (drawing 4). And although said 2nd passage material 61 is equipped with the tube-like liquid phantom outflow way 62, said 2nd passage material 61 uses the mold goods of the resin on which the outflow way 62 pastes up the mold goods of the resin which is not pasted up on the 1st phantom layer 31 like the 1st passage material 51 again.

[0015] As mentioned above, when making the point of the 1st passage material 51, and the point of the 2nd passage material 61 meet the external surface of the 1st phantom layer 31 and piling up a part, opening of the 2nd female 321 which fabricates the outside configuration of said 2nd phantom layer 32 is assigned, and the 1st phantom layer 31 is made buried in the interior of the 2nd female 321. And if the material 41 for cavities is poured in and hardened in the opening section constituted from external surface of the 1st phantom layer 31, and an inside of the 2nd female 321, while unmolding, it will leave the material 41 for cavities of only the part which constitutes the cavernous section 4, carry out cutting removal of the other materials 41 for cavities, and let the part of the material 41 for cavities which remains be the material section 42 for cavities (drawing 5 R> 5). In this case, where the point of said 1st passage material 51 and 2nd passage material 61 is embedded, it exists in the interior of the material section 42 for cavities. Although the extent configuration which is ordinary temperature is maintained as said material 41 for cavities, if it warms, raw materials, such as an agar which liquefies easily, and gelatin, or the raw material which liquefies easily with chemicals can be used.

[0016] Therefore, as (d) of drawing 5 shows, the material section 42 for cavities with which the point of the 1st passage material 51 and the 2nd passage material 61 is connected is formed in a part of external surface of the 1st phantom layer 31.

[0017] Apply again the 1st phantom layer 31 which has the above mentioned material section 42 for cavities to opening of the 2nd female 321, and it is engrossed in the interior. In order to fabricate the 2nd phantom layer 32 in the opening section of the external surface of the 1st phantom layer 31, and the inside of the 2nd female 321 By mixing a titanium oxide particle, ink, a color, etc. to an epoxy resin or polyester resin, an optical property supplies and stiffens the raw material adjusted to the request, and unmolds (drawing 6). Therefore, although the material section 42 for cavities is formed in the external surface of the above

mentioned 1st phantom layer 31 at the part, the 2nd phantom layer 32 will cover into other parts, and will be fabricated (drawing 6 (c)).

[0018] Next, the phantom which has two-layer [of the 1st phantom layer 31 and the 2nd phantom layer 32] in said plinth 2 You assign opening of the 3rd female 331 which fabricates the 3rd phantom layer 33, and make it buried in the interior. In order to fabricate the 3rd phantom layer 33 to the opening circles formed of the inside of said 3rd female 331, and the external surface of the 2nd phantom layer 32 By mixing a titanium oxide particle, ink, a color, etc. to an epoxy resin or polyester resin, an optical property supplies and stiffens the raw material adjusted to the request, and unmolds (drawing 7). Therefore, the 3rd phantom layer 33 covers on the external surface of the 2nd phantom layer 32 which has the material section 42 for cavities in a part, and is fabricated, and it becomes the phantom in which three layers carry out a laminating to a plinth 2 (drawing 7 (c)).

[0019] If the above mentioned phantom of three layers is fabricated, while forming the inlet-port passage 5 and the outlet passage 6 in the 1st phantom layer 31 and the 2nd phantom layer 32 by drawing out the 1st passage material 51 and the 2nd passage material 61 which can be crooked, the inflow way 52 and the outflow way 62 are made to exist in tip opening of the inlet-port passage 5 and the outlet passage 6 (drawing 8 (b)). this condition -- setting -- warming -- it warms at the temperature of extent which does not give denaturation to each raw material of the 1st phantom layer 31, the 2nd phantom layer 32, and the 3rd phantom layer 33 using - heating device 101, and said material section 42 for cavities is made to liquefy (drawing 8 (c)) Moreover, if it is the ingredient which the material for cavities dissolves easily with chemicals, and liquefies, chemicals will be poured in from the inflow way 52 and the material for cavities will be dissolved. In this case, as chemicals, it must not react with the epoxy resin or polyester resin which constitute each class of the 1st phantom layer 31, the 2nd phantom layer 32, and the 3rd phantom layer 33.

[0020] If said material section 42 for cavities softens and it fully liquefies, the pressure of air or warm water will be made to act on the material section 42 for cavities which connects the pressure feeder style 102 to the inflow way 52, and is liquefying on it, and the material section 42 for cavities will be discharged outside from the outflow way 62. In this case, if the material section 42 for cavities is colored by using the 3rd phantom layer 33 as a transparent layer and color is made different to the 2nd phantom layer 32 It can check easily that the material section 42 for cavities is discharged through the 3rd phantom layer 33. By discharging the material section 42 for cavities, the cavernous section 4 is constituted by the 2nd phantom layer 32, and said cavernous section 4 is inserted by the external surface of the 1st phantom layer 31, and the inside of the 3rd phantom layer 33. Therefore, the phantom three layers of the 1st phantom layer 31, and the 2nd phantom layer 32 which has the cavernous section 4 and the 3rd phantom layer 33 carry out [a phantom] a laminating to a plinth 2 is fabricated (drawing 9 (b)).

[0021] Assign said phantom of three layers to opening of the 4th female 341 for fabricating the 4th phantom layer 34, and it is made buried in the interior. In order to fabricate the 4th phantom layer 34 to the opening circles formed of the inside of the 4th female 341, and the external surface of the 3rd phantom layer 33 By mixing a titanium oxide particle, ink, a color, etc. to an epoxy resin or polyester resin, the raw material with which the optical property was adjusted is supplied and stiffened, and the phantom which unmolded and carried out the laminating of the four layers of the 1st phantom layer 31 to the 4th phantom layer 34 is fabricated (drawing 10).

[0022] Subsequently, assign said phantom of four layers to opening of the 5th female 351 for fabricating the 5th phantom layer 35, and it is made buried in the interior. In order to fabricate the 5th phantom layer 35 to the opening circles formed of the inside of the 5th female 351, and the external surface of the 4th phantom layer 34 By mixing a titanium oxide particle, ink, a color, etc. to an epoxy resin or polyester resin, the raw material with which the optical property was adjusted is supplied and stiffened, and the phantom which unmolded and carried out the laminating of the five layers of the 1st phantom layer 31 to the 5th phantom layer 35 is fabricated (drawing 11).

[0023] By the above mentioned approach, an optical property is adjusted in each phantom layer, and the

optical phantom 1 of this invention in which the inlet-port passage 5 and the outlet passage 6 which can be discharged which moreover forms the cavernous section 4 in a part, and can supply phantom liquid were formed can be manufactured.

[0024] Although this invention was explained based on the gestalt of operation shown in a drawing above, this invention is not limited to the gestalt of said operation, and unless the configuration of a publication is changed into a claim, it can be carried out even to how. For example, the phantom equivalent to all the parts of not only the body but an animal can be created, and all conditions, such as a blood flow, a fluctuation condition of the oxygen of an in-house, and an intracellular sugar change, can be assumed as a phantom liquid poured in the cavernous section. moreover, a two or more layers phantom layer can prepare other than five layer, as shown in the gestalt of said operation, and the cavernous section can also prepare it in which layer or what kind of location. Furthermore, in the above-mentioned explanation by this invention, really fabricating the inflow way 52 and the outflow way 62 may attach pipe-like the inflow way 52 and the outflow way 62 in the open end of the inlet-port passage 5 and the outlet passage 6 according to adhesives, a screw device, etc. not after indispensable requirements but after shaping of a phantom at balking impossible, respectively.

[0025]

[Effect of the Invention] In short, according to this invention, the configuration of the target living body's part is constituted by carrying out the laminating of two or more phantom layers above. The cavernous section is prepared or more in a part of phantom 1 of said two or more phantom layers. It is characterized by making the dynamic active state changed by time amount simulate, and making it measure optically by connecting the inlet-port passage and outlet passage which carry out opening outside, passing the liquid phantom made to flow from said inlet-port passage in the cavernous section, and making it flow into said cavernous section out of outlet passage. Therefore, while making some parts of living bodies, such as the body and an animal, simulate an activity part and the lesion section by the cavernous section Since the dynamic active state changed by time amount by making the part carry out false [of the change of a blood flow, the flow of the oxygen under organization, and intracellular sugar etc.] can be made to be able to simulate and it can measure optically In development of a medical diagnostic device and a therapy device using light, light spreads the interior of a living body how. Moreover, which part of a living body can be diagnosed, or it can clarify whether it treats, and exact moreover a high precision not only can estimate the effectiveness of a diagnostic device or a therapy device especially, but it can contribute remarkably in the field of a diagnosis of a living body or a therapy.

[0026] And since the material section for cavities is prepared, the cavernous section is prepared by making the material section for cavities discharge and the optical phantom was manufactured while forming 1 or two or more phantom layers by the female on the surface of the plinth, remarkably simply, the phantom of any gestalten can be produced and it becomes the remarkable high thing of practical value in the diagnosis and therapy especially in the medicine industry.

TECHNICAL FIELD

[Field of the Invention] This invention relates to optical phantom and its manufacture approach of the living body which can measure the dynamic active state changed by time amount in a medical diagnosis or development of a therapy device.

PRIOR ART

[Description of the Prior Art] In development of a medical diagnostic device and a therapy device using light, it is very difficult to clarify how light spreads the interior of a living body, and which part of a living body is diagnosed or it treats. Then, the phantom which simulated the body and other living bodies optically is produced, and if the part which simulated the activity of various kinds of lesion sections or an organization can be prepared in this phantom, the effectiveness of a diagnostic device or a therapy device can be evaluated correctly.

EFFECT OF THE INVENTION

[Effect of the Invention] In short, according to this invention, the configuration of the target living body's part is constituted by carrying out the laminating of two or more phantom layers above. The cavernous section is prepared or more in a part of phantom 1 of said two or more phantom layers. It is characterized by making the dynamic active state changed by time amount simulate, and making it measure optically by connecting the inlet-port passage and outlet passage which carry out opening outside, passing the liquid phantom made to flow from said inlet-port passage in the cavernous section, and making it flow into said cavernous section out of outlet passage. Therefore, while making some parts of living bodies, such as the body and an animal, simulate an activity part and the lesion section by the cavernous section Since the dynamic active state changed by time amount by making the part carry out false [of the change of a blood flow, the flow of the oxygen under organization, and intracellular sugar etc.] can be made to be able to simulate and it can measure optically In development of a medical diagnostic device and a therapy device using light, light spreads the interior of a living body how. Moreover, which part of a living body can be diagnosed, or it can clarify whether it treats, and exact moreover a high precision not only can estimate the effectiveness of a diagnostic device or a therapy device especially, but it can contribute remarkably in the field of a diagnosis of a living body or a therapy.

[0026] And since the material section for cavities is prepared, the cavernous section is prepared by making the material section for cavities discharge and the optical phantom was manufactured while forming 1 or two or more phantom layers by the female on the surface of the plinth, remarkably simply, the phantom of any gestalten can be produced and it becomes the remarkable high thing of practical value in the diagnosis and therapy especially in the medicine industry.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the former, although the phantom of the shape of plate-like or a cylinder is produced, an optical phantom which bears a close resemblance [living body] is not proposed. Moreover, although this invention person etc. has already proposed the optical phantom which is simulating the body, the phantom which can measure optically the dynamic active state changed by time amount is not yet proposed, for example like muscles, a brain, or a blood flow. Then, this invention person etc. aims at proposing the phantom which can measure the dynamic active state changed by time amount for the first time this time.

MEANS

[Means for Solving the Problem] In order to attain said purpose of this invention, this invention The

configuration of the target living body's part is constituted by carrying out the laminating of two or more phantom layers. The cavernous section is prepared or more in a part of phantom 1 of said two or more phantom layers. By connecting the inlet-port passage and outlet passage which carry out opening outside, passing the liquid phantom made to flow from said inlet-port passage in the cavernous section, and making it flow into said cavernous section out of outlet passage The optical phantom of the living body characterized by making the dynamic active state changed by time amount simulate, and making it measure optically, And as the passage material was prepared in the plinth and said passage material was laid under the front face of said plinth, after making 1 or two or more phantom layers form by the female, When forming in order the phantom layer which prepares the material section for cavities and contains the material section for cavities by the female, and the phantom layer of the outside so that said passage material may contact While removing said passage material and constituting inlet-port passage and outlet passage, the material section for cavities is made to discharge from said passage, and the manufacture approach of the optical phantom of the living body characterized by forming a desired phantom layer outside after that is offered.

[0005]

[Embodiment of the Invention] This invention is explained based on the gestalt of operation shown in a drawing below. The optical phantom 1 of this invention is the configuration to which the front face of a plinth 2 is made to carry out the laminating of two or more phantom layers 3 when an outline is carried out, as shown in drawing 1, and formed the cavernous section 4 in a part of one or more phantom layers 3, made the inlet-port passage 5 and the outlet passage 6 open said cavernous section 4 for free passage, and opening of each passage 5 and 6 was made to carry out outside.

[0006] Although said plinth 2 is the configuration of being a product made of synthetic resin and having formed reinforcing materials 22 in the interior of the circular ring material 21 in the shape of a cross joint with the gestalt of operation shown in a drawing, it may be fabricated by this invention with the quality of the material like a throat other than this, and, moreover, may be what kind of configuration.

[0007] The head of the body is simulated as said optical phantom 1. Moreover, the phantom layer 3 With the gestalt of operation of a drawing, the laminating of the five phantom layers has been carried out toward the exterior from the interior. The 2nd phantom layer 32 of the outside white matter gray matter [the innermost 1st phantom layer 31] In the layer of cerebrospinal fluid, the 3rd phantom layer 33 of the outside is [the 4th phantom layer 34 of the outside] the outside about a skull layer, and the outermost 5th phantom layer 35 assumes the stratum cutaneum membranae tympani of a head, respectively.

[0008] Each class from said 1st phantom layer 31 to the 5th phantom layer 35 is taken as a configuration with the optical property corresponding to the part of each head by adjusting a titanium oxide particle, ink, a color, etc. to an epoxy resin or polyester resin, and mixing.

[0009] And while forming said cavernous section 4 in the location which simulates an activity part or the lesion sections, such as a living body's cell and an organization, or more to a part of phantom 1 of said 1st phantom layer 31 to the 5th phantom layers 35 Connect to said cavernous section 4 said inlet-port passage 5 and outlet passage 6 which simulate a blood vessel, and it is made outside open for free passage. By slushing into the cavernous section 4 the phantom liquid which simulates the lesion section and organization activities from the inlet-port passage 5 using the liquid circulator style which ***** prepared, and making it flow out of the outlet passage 6 The liquid of a blood flow and others which changes with the activities of muscles or a brain can be made to be able to simulate, the dynamic active state changed by time amount can be made to be able to simulate in the interior of a phantom, and it can measure optically. Therefore, by making the part carry out false [of the change of a blood flow, the flow of the oxygen under organization, and intracellular sugar etc.], the optical phantom 1 of this invention can make the dynamic active state changed by time amount able to simulate, and can be optically measured while making some parts of living bodies, such as the body and an animal, simulate an activity part and the lesion section.

[0010] The manufacture approach of the optical phantom 1 of this invention is explained based on the gestalt of operation shown below in drawing 2 below.

[0011] By explanation of said optical phantom 1, since the head of the body is simulated, how to produce the phantom also in the manufacture approach is explained below. Beforehand, two or more tomogram data of a head are obtained from an anatomical classification using three-dimensions configuration data collectors, such as MRI and X-ray CT, and the model data of an optical phantom are produced. Next, two or more above-mentioned model data are supplied to the Mitsuzo form machine, a pattern is produced for every fault using a photo-setting resin etc., and a female is produced by making silicone rubber into a raw material from each pattern. therefore, the voice of operation of drawing 1 -- in the optical phantom shown like, from the 1st five female 311 made of silicone rubber for fabricating from the 1st phantom layer 31 to the 5th phantom layer 35 to the 5th female 351 is produced beforehand, and is prepared.

[0012] While making the 1st passage material 51 for forming the inlet-port passage 5 in the center position of said plinth 2 insert in Said 1st passage material 51 is equipped with the tube-like liquid phantom inflow way 52. It lays in opening of the 1st female 311 which fabricates the outside configuration of the 1st phantom layer 31. An optical property supplies the raw material adjusted to the request by mixing a titanium oxide particle, ink, a color, etc. from opening of a plinth 2 to an epoxy resin or polyester resin at opening of the 1st female 311 (drawing 2). And the 1st phantom layer 31 which is in agreement with the inside configuration of the 1st female 311 is fabricated by the plinth 2 by unmolding, when the raw material supplied to the interior of said 1st female 311 hardens. in addition, the Teflon resin which can be crooked without pasting up said 1st passage material 51 on an epoxy resin or polyester resin -- the shape of a rod -- or the thing fabricated in the shape of a tube -- moreover, said inflow way 52 uses what was fabricated in the shape of a tube by the resin adhered to said epoxy resin or polyester resin.

[0013] When said 1st female 311 is removed and the 1st phantom layer 31 is formed in a plinth 2, the 1st passage material 51 fabricated by the resin which is not pasted up is extruded, and the point of the 1st passage material 51 is made to project on the external surface of the 1st phantom layer 31 (drawing 3).

[0014] The point of the 1st passage material 51 which projects from the external surface of said 1st phantom layer 31 Make the 2nd passage material 61 for forming the outlet passage 6, while making it crooked so that the external surface of the 1st phantom layer 31 may be contacted there be along the external surface of the 1st phantom layer 31, and it is made and prepared in it. In the external surface of the 1st phantom layer 31, the laminating of the point of said 1st passage material 51 and the point of the 2nd passage material 61 is carried out (drawing 4). And although said 2nd passage material 61 is equipped with the tube-like liquid phantom outflow way 62, said 2nd passage material 61 uses the mold goods of the resin on which the outflow way 62 pastes up the mold goods of the resin which is not pasted up on the 1st phantom layer 31 like the 1st passage material 51 again.

[0015] As mentioned above, when making the point of the 1st passage material 51, and the point of the 2nd passage material 61 meet the external surface of the 1st phantom layer 31 and piling up a part, opening of the 2nd female 321 which fabricates the outside configuration of said 2nd phantom layer 32 is assigned, and the 1st phantom layer 31 is made buried in the interior of the 2nd female 321. And if the material 41 for cavities is poured in and hardened in the opening section constituted from external surface of the 1st phantom layer 31, and an inside of the 2nd female 321, while unmolding, it will leave the material 41 for cavities of only the part which constitutes the cavernous section 4, carry out cutting removal of the other materials 41 for cavities, and let the part of the material 41 for cavities which remains be the material section 42 for cavities (drawing 5 R> 5). In this case, where the point of said 1st passage material 51 and 2nd passage material 61 is embedded, it exists in the interior of the material section 42 for cavities. Although the extent configuration which is ordinary temperature is maintained as said material 41 for cavities, if it warms, raw materials, such as an agar which liquefies easily, and gelatin, or the raw material which liquefies easily with chemicals can be used.

[0016] Therefore, as (d) of drawing 5 shows, the material section 42 for cavities with which the point of the 1st passage material 51 and the 2nd passage material 61 is connected is formed in a part of external surface of the 1st phantom layer 31.

[0017] Apply again the 1st phantom layer 31 which has the above mentioned material section 42 for cavities to opening of the 2nd female 321, and it is engrossed in the interior. In order to fabricate the 2nd phantom layer 32 in the opening section of the external surface of the 1st phantom layer 31, and the inside of the 2nd female 321 By mixing a titanium oxide particle, ink, a color, etc. to an epoxy resin or polyester resin, an optical property supplies and stiffens the raw material adjusted to the request, and unmolds (drawing 6). Therefore, although the material section 42 for cavities is formed in the external surface of the above mentioned 1st phantom layer 31 at the part, the 2nd phantom layer 32 will cover into other parts, and will be fabricated (drawing 6 (c)).

[0018] Next, the phantom which has two-layer [of the 1st phantom layer 31 and the 2nd phantom layer 32] in said plinth 2 You assign opening of the 3rd female 331 which fabricates the 3rd phantom layer 33, and make it buried in the interior. In order to fabricate the 3rd phantom layer 33 to the opening circles formed of the inside of said 3rd female 331, and the external surface of the 2nd phantom layer 32 By mixing a titanium oxide particle, ink, a color, etc. to an epoxy resin or polyester resin, an optical property supplies and stiffens the raw material adjusted to the request, and unmolds (drawing 7). Therefore, the 3rd phantom layer 33 covers on the external surface of the 2nd phantom layer 32 which has the material section 42 for cavities in a part, and is fabricated, and it becomes the phantom in which three layers carry out a laminating to a plinth 2 (drawing 7 (c)).

[0019] If the above mentioned phantom of three layers is fabricated, while forming the inlet-port passage 5 and the outlet passage 6 in the 1st phantom layer 31 and the 2nd phantom layer 32 by drawing out the 1st passage material 51 and the 2nd passage material 61 which can be crooked, the inflow way 52 and the outflow way 62 are made to exist in tip opening of the inlet-port passage 5 and the outlet passage 6 (drawing 8 (b)). this condition -- setting -- warming -- it warms at the temperature of extent which does not give denaturation to each raw material of the 1st phantom layer 31, the 2nd phantom layer 32, and the 3rd phantom layer 33 using - heating device 101, and said material section 42 for cavities is made to liquefy (drawing 8 (c)) Moreover, if it is the ingredient which the material for cavities dissolves easily with chemicals, and liquefies, chemicals will be poured in from the inflow way 52 and the material for cavities will be dissolved. In this case, as chemicals, it must not react with the epoxy resin or polyester resin which constitute each class of the 1st phantom layer 31, the 2nd phantom layer 32, and the 3rd phantom layer 33.

[0020] If said material section 42 for cavities softens and it fully liquefies, the pressure of air or warm water will be made to act on the material section 42 for cavities which connects the pressure feeder style 102 to the inflow way 52, and is liquefying on it, and the material section 42 for cavities will be discharged outside from the outflow way 62. In this case, if the material section 42 for cavities is colored by using the 3rd phantom layer 33 as a transparent layer and color is made different to the 2nd phantom layer 32 It can check easily that the material section 42 for cavities is discharged through the 3rd phantom layer 33. By discharging the material section 42 for cavities, the cavernous section 4 is constituted by the 2nd phantom layer 32, and said cavernous section 4 is inserted by the external surface of the 1st phantom layer 31, and the inside of the 3rd phantom layer 33. Therefore, the phantom three layers of the 1st phantom layer 31, and the 2nd phantom layer 32 which has the cavernous section 4 and the 3rd phantom layer 33 carry out [a phantom] a laminating to a plinth 2 is fabricated (drawing 9 (b)).

[0021] Assign said phantom of three layers to opening of the 4th female 341 for fabricating the 4th phantom layer 34, and it is made buried in the interior. In order to fabricate the 4th phantom layer 34 to the opening circles formed of the inside of the 4th female 341, and the external surface of the 3rd phantom layer 33 By mixing a titanium oxide particle, ink, a color, etc. to an epoxy resin or polyester resin, the raw material with which the optical property was adjusted is supplied and stiffened, and the phantom which unmolded and carried out the laminating of the four layers of the 1st phantom layer 31 to the 4th phantom layer 34 is fabricated (drawing 10).

[0022] Subsequently, assign said phantom of four layers to opening of the 5th female 351 for fabricating the 5th phantom layer 35, and it is made buried in the interior. In order to fabricate the 5th phantom layer 35 to

the opening circles formed of the inside of the 5th female 351, and the external surface of the 4th phantom layer 34 By mixing a titanium oxide particle, ink, a color, etc. to an epoxy resin or polyester resin, the raw material with which the optical property was adjusted is supplied and stiffened, and the phantom which unmolded and carried out the laminating of the five layers of the 1st phantom layer 31 to the 5th phantom layer 35 is fabricated (drawing 11).

[0023] By the above mentioned approach, an optical property is adjusted in each phantom layer, and the optical phantom 1 of this invention in which the inlet-port passage 5 and the outlet passage 6 which can be discharged which moreover forms the cavernous section 4 in a part, and can supply phantom liquid were formed can be manufactured.

[0024] Although this invention was explained based on the gestalt of operation shown in a drawing above, this invention is not limited to the gestalt of said operation, and unless the configuration of a publication is changed into a claim, it can be carried out even to how. For example, the phantom equivalent to all the parts of not only the body but an animal can be created, and all conditions, such as a blood flow, a fluctuation condition of the oxygen of an in-house, and an intracellular sugar change, can be assumed as a phantom liquid poured in the cavernous section. moreover, a two or more layers phantom layer can prepare other than five layer, as shown in the gestalt of said operation, and the cavernous section can also prepare it in which layer or what kind of location. Furthermore, in the above-mentioned explanation by this invention, really fabricating the inflow way 52 and the outflow way 62 may attach pipe-like the inflow way 52 and the outflow way 62 in the open end of the inlet-port passage 5 and the outlet passage 6 according to adhesives, a screw device, etc. not after indispensable requirements but after shaping of a phantom at balking impossible, respectively.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing of longitudinal section of the optical phantom of the living body which shows the gestalt of operation of this invention.

[Drawing 2] It is a schematic diagram in the condition of producing the 1st phantom layer, and (a) is a perspective view and (b) is drawing of longitudinal section.

[Drawing 3] It is an outline perspective view in the condition of having fabricated the 1st phantom layer to the plinth.

[Drawing 4] It is an approximate account Fig. in the condition of producing the 1st passage material and the 2nd passage material on the front face of the 1st phantom layer, and the perspective view in the condition that (a) extended the 1st passage material, the perspective view in the condition that (b) made the 1st passage material crooked along the external surface of the 1st phantom layer, and (c) are the perspective views in the condition of having made the 2nd passage material crooked along the external surface of the 1st phantom layer.

[Drawing 5] It is an approximate account Fig. in the condition of preparing the layer of the material for cavities in the external surface of the 1st phantom layer, and producing the material section for cavities, and they are a perspective view in the condition that the perspective view unmolded (a) and drawing of longitudinal section and (c) unmolded (b), and a perspective view in the condition of (d) having deleted some materials for cavities and having fabricated the material section for cavities.

[Drawing 6] It is an approximate account Fig. in the condition of producing the 2nd phantom layer on the front face of the 1st phantom layer, and (a) is the perspective view with which a perspective view and (b)

fabricated drawing of longitudinal section, and (c) fabricated the 2nd phantom layer.

[Drawing 7] It is an approximate account Fig. in the condition of producing the 3rd phantom layer on the front face of the 2nd phantom layer, and (a) is the perspective view with which a perspective view and (b) fabricated drawing of longitudinal section, and (c) fabricated the 3rd phantom layer.

[Drawing 8] It is an outline perspective view in the condition of liquefying the material section for cavities, and the perspective view with which (a) fabricated the 3rd phantom layer, the perspective view in the condition that (b) drew out the 1st passage material and the 2nd passage material, and (c) are the outline perspective views of a heating condition.

[Drawing 9] It is an outline perspective view in the condition of forming the cavernous section, and they are a perspective view in the condition that (a) removes the material section for cavities, and the perspective view which (b) removed the material section for cavities and formed the cavernous section.

[Drawing 10] It is an approximate account Fig. in the condition of producing the 4th phantom layer on the front face of the 3rd phantom layer, and (a) is the perspective view with which a perspective view and (b) fabricated drawing of longitudinal section, and (c) fabricated the 4th phantom layer.

[Drawing 11] It is an approximate account Fig. in the condition of producing the 5th phantom layer on the front face of the 4th phantom layer, and (a) is the perspective view with which a perspective view and (b) fabricated drawing of longitudinal section, and (c) fabricated the 5th phantom layer.

[Description of Notations]

- 1 Optical Phantom
- 2 Plinth
- 3 Phantom Layer
- 4 Cavernous Section
- 5 Inlet-Port Passage
- 6 Outlet Passage
- 31 1st Phantom Layer
- 32 2nd Phantom Layer
- 33 3rd Phantom Layer
- 34 4th Phantom Layer
- 35 5th Phantom Layer
- 41 Material for Cavities
- 42 Material Section for Cavities
- 51 1st Passage Material
- 52 Inflow Way
- 61 2nd Passage Material
- 62 Outflow Way

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